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XXIV.—Excerpta Botanica, *or abridged Extracts translated from the Foreign Journals, illustrative of, or connected with, the Botany of Great Britain.* By W. A. Leighton, Esq., B.A., F.B.S.E., &c.

No. 6. *On the Development of the Reproductive Organs of the Misseltoe* (Viscum album, *Linn.*). By M. Decaisne. (Ann. des Sci. Nat. n. s. xiii. p. 292.)*

The male flower of the Misseltoe begins to be visible for nearly a year before its expansion. The anther is then not distinguishable from the green calyx by which it is embraced, except by the absence of colour, being formed of cellular tissue, the meshes of which are of similar form and dimensions. Somewhat later, in this interior and colourless portion, are formed many lacunæ, which apparently result from the destruction of the cellular tissue over these points, and which become filled with a mucilaginous fluid. A little later still, this mucilage is observed to be composed of utricules, with soft, very thin and transparent walls, considerably larger than the utricules of the adjacent parts, and connected solely by a viscous fluid. At this time the anther is constituted of three kinds of cellules; viz. the primi-

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tive colourless cellules, which still form the greater portion of the mass; other cellules, of a grey or yellow colour, in the vicinity of the lacunæ, of which they constitute the walls, and chiefly remarkable by the presence of a central nucleus; and those larger cellules which fill the lacunæ, and which are identical with the utricules termed *polliniferous* by Mirbel.

These transparent utricules soon become obscured by the presence of numerous granules, in the midst of which are observed one or two bodies, likewise granular, but considerably larger, which we shall term nuclei (*noyaux*). These granules become gradually collected into a single mass in the centre of the utricule, which is thus rendered more opake in the centre, though still transparent through the increased thickness of its circumference. This mass may with care be abstracted entire from the cavity in which it is enclosed, when the nuclei will be found united, and at the end of some days four may be distinguished.

After the lapse of some time we perceive nothing more than these nuclei, the absorbed granules having disappeared. The nuclei are only separated by matter which at first is fluid, but subsequently becomes solidified, and their form is that of so many separate cells. During this same time, this matter becomes equally solidified on the interior walls of the utricule, so as to form a thickening, which is apparently the result of many successive layers, and its transparence becomes altered. Such is the state of the anther about four months after the appearance of the bud, when it exhibits on its internal face a considerable number of small cells, which are merely closed by the epidermis which extends over their apertures. In each of these cells are pollinic utricules, with thick succulent walls, marked with concentric zones, their internal cavity divided by thinner walls into four still smaller cavities, containing as many granular nuclei, which, on the rupture of their envelope under water, escape.

These latter nuclei continue to grow, become round and invested with a yellow papillose integument, and with their growth the walls and divisions of the utricules gradually diminish and finally disappear, when the nuclei of the different utricules are found all free together in the common cavity previously occupied by the polliniferous utricules; in short, they become so many grains of pollen in one of the cells of the anther. From this time these grains assume that external appearance which they ever afterwards retain, although not yet arrived at their complete development, which still goes forward in their interior. If by a slight pressure we burst one of them, the nucleus issues forth, together with

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numerous scattered granules, from the external envelope, which is bristled over with minute asperities. When the grain is completely matured, a similar pressure causes the protrusion, from the same envelope, of a vesicle, which, on being itself burst, emits a multitude of granules; but there is no appearance of a nucleus.

On reviewing the above series of changes, we perceive that the formation seems generally to proceed from the exterior towards the interior, seeing that the vesicles are organized and filled with granules, in the midst of which are observed many centres (*moules*), which, to the number of four, associate or absorb the rest of the granules; that these vesicles become thickened by the formation of successive layers more and more internal, and are divided by their interposition between the granular centres; that these centres are invested with a primary envelope, which is finally lined on the inside by a final membrane, which immediately encloses the granules. These different parts are not co-existent, the older ones disappearing first, and probably furnishing the materials for the more recent, of which, in other respects, they do not constitute a part.

These observations accord both with those which are considered the most complete and certain on the formation of tissues, as well as with those which relate more particularly to the formation of pollen. To this latter phænomenon they contribute many new facts: such as the presence of these nuclei, the primary germs of the pollinic grains; the deposition of many successive layers on the walls of the mother utricule, and the instantaneous formation of divisions to which they themselves conduce; the origin of the proper envelope of the pollen.

In most other plants, when pollen arrives at maturity, some peculiar change takes place in the cellules constituting the internal walls of the cell, whose zones become thickened, and are finally divided into elastic filaments, whose play determines the dehiscence of the anther. Nothing similar to this takes place in the Misseltoe, whose anther can be scarcely said to be dehiscent, inasmuch as its cells are externally open. Moreover, the cellules composing its wall continue in the state above described, their component membrane being persistent, and of uniform thickness.

Nearly at the same time when the pollen has attained perfect maturity, the female flower is expanded, and the pollinic action is then for the first time able to take effect upon the newly-disclosed stigma. Nevertheless, the most delicate observation has failed to detect the ovulum either at this period

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or for a long time after; in the minute flower, the tissue of the calyx, and that of the ovary in the centre agglutinated to it, being only visible, and a little later, in the interior of this ovary, at first plain, two small lacunæ are seen, which finally enlarge, unite, and form one cell with contiguous walls.

It is not until more than three months later that there is perceived at the bottom of this compressed cavity a very small, cone-shaped, pulpy body, accompanied by one or two still smaller club-shaped filaments. These are so many erect ovula, in two of which there is generally the commencement of abortion. They are composed of utricules superposed in circles, which in the ovulum to be developed are few in number, and in the abortive ovula are even reduced to a single one. In these utricules are a nucleus, and very numerous and minute grains of fecula.

The ovulum, on its appearance, increases rapidly, and after some days a small spot is detected towards its summit, which indicates the embryo. The development of this embryo, from its first appearance to maturity, has been observed by M. Decaisne, and is similar to that of other Dicotyledons.

It is different, however, with the body surrounding the ovulum. In general, as is well known, the ovulum is formed of many envelopes, enclosed one within the other, one or two of those most exterior being open at their summits, and the two innermost perfectly closed.

But M. Decaisne has been unable to discover in the ovulum of the Misseltoe any corresponding opening at the summit, and he has been led to conclude that the exterior envelopes (primine and secundine) are absent, and that the ovulum is a naked nucleus. He has moreover ascertained this nut to be composed of a homogeneous tissue throughout its whole thickness, which immediately embraces the embryo, and hence deduces the non-existence of a quintine or embryonic sac. It is in reality an ovulum reduced to its simplest expression, a sac enclosing the embryo. This sac thickens and solidifies as it grows, and forms a perisperm, the colour of which, being green, is unique among the families of plants. M. Decaisne has followed the progress of this colouring, which extends progressively from the base to the summit; he has seen, in the cellules of the nut, besides the nucleus and the grains of fecula by which at first it was exclusively filled, numerous green granules, which mingle with, but do not cover, the others; and he has thus observed this to be the process of the green tint in the vegetable tissues.

Another anomaly in the seed of Misseltoe is the plurality of embryos. This plurality is not rare in a great many

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M. Decaisne's discovery of many ovula in the bottom of each ovary leads to the most natural explanation of this phænomenon. In a great number of cases, two of these ovula are abortive, and then a single embryo only is found in the mature seed; but in other instances, two, or even three ovula, being fertilized, are developed and united by their bases, and then we have so many embryos diverging at their summits.

The results of this theory are, that it reduces the many apparent anomalies of the Misseltoe to a single real one, the unity of the ovular envelope, and thus restores the development of its seeds to known laws. It also effaces in part the difference between the ovular covering in the European Misseltoe and that of the Indian species noticed by Mr. Griffith, and in which three ovula are detected in each cell on a central support. Our Misseltoe thus forms a transition between them and *Loranthus*, in which the ovulum is really single and erect.

M. Decaisne has added to his memoir an examination of the anatomical structure of the stem. A young branch exhibits in its centre a green pith, surrounded by a case formed of woody bundles, generally eight in number. In these bundles we find no tracheæ; but nearly in the situation which they should occupy, only annular vessels. These, together with the elongated and pointed, or reticulated cellules, and the fibres analogous to those of the liber, constitute the whole vascular system of the plant, which is besides composed of utricules, in which abound, together with granules of starch, granules of green matter. Outside, and opposite to the woody bundles, are as many smaller ones, formed exclusively of fibres of liber, and which may therefore be termed *cortical*. The woody bundles are continued from one branch into another, whilst the cortical bundles are interrupted, after being attenuated, at each joint, whence results the facility with which the branches are disarticulated.

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plants, being accidental in the greater number, though always constant in some. Ordinarily it occurs in seeds destitute of perisperm; but when this perisperm is also present, the embryos are pressed together at the same height, or at slightly different heights. This, however, is not so in the Misseltoe; for the embryos, two, or more rarely three in number, all touch each other by their lower extremities, and diverge at their upper or radicular extremities, which are distant, and separated by a portion of the perisperm, from which they slightly project.

M. Decaisne's discovery of many ovula in the bottom of each ovary leads to the most natural explanation of this phænomenon. In a great number of cases, two of these ovula are abortive, and then a single embryo only is found in the mature seed; but in other instances, two, or even three ovula, being fertilized, are developed and united by their bases, and then we have so many embryos diverging at their summits.

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